

POLARIMETRIC THERMAL EMISSION FROM
PERIODIC WATER SURFACES

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Abstract

In this paper, experimental results and theoretical calculations are presented to study the polarimetric emission from water surfaces with directional features. For our ground-based Ku-band radiometer measurements, a water pool was constructed on the roof of a building in the Jet Propulsion Laboratory and a fiberglass surface with periodic corrugations in one direction was impressed on the top of water surface to create a stationary water surface underneath it. It is observed that the measured Stokes parameters of corrugated fiberglass-covered water surfaces are functions of azimuth angles and agree very well with theoretical calculations. The theory, after verified by the experimental data, was then used to calculate the Stokes parameters of periodic surfaces without fiberglass surface layer and with rms height of the order of wind-generated water ripples. The magnitudes of the azimuthal variation of the calculated emissivities at horizontal and vertical polarizations corresponding to the first two Stokes parameters are found to be comparable to the values measured by airborne radiometer and SSM/I. In addition, the third Stokes parameter not shown in the literature is seen to have approximately twice the magnitude of the azimuth variation of either T_h or T_v which may make it more sensitive to the row direction, while less susceptible to noises because the atmospheric and system noises tend to be unpolarized and are expected to be cancelled out when the third Stokes parameter is derived as the difference of two or three power measurements as indicated by our another experiment carried out at a swimming pool with complicated surroundings. The results of this paper indicate that passive polarimetry is a potential technology in the remote sensing of ocean wind vector which is a crucial component in the understanding of global climate change. Issues related to the application of microwave passive polarimetry to ocean wind are also discussed.